Literacy Northwest — Regional Literacy & Basic Skills Network

OALCF Tasks for the Apprenticeship Goal Path: Prepared for the Project, *Developing Best Practices for Increasing, Supporting and Retaining Apprentices in Northern Ontario (2014)*

OALCF Task Cover Sheet

Task Title: Understand V-Belts and Calculate Sizes

Learner Name:
Date Started: **Date Completed:**   **Successful Completion:**   Yes___   No___
Goal Path: Employment___   Apprenticeship✓   Secondary School___   Post Secondary___   Independence___
Task Description: Understand information about V-belts and calculating their length.

Competency:	**Task Group(s):**
A: Find and Use Information	A1: Read continuous text
B: Communicate Ideas and Information	A2: Interpret documents
C: Use Numbers	B2: Write continuous text
D: Use Digital Technology	D2: Digital technology

Level Indicators:

A1.2: Read texts to locate and connect ideas and information

A1.3: Read longer texts to connect, evaluate and integrate ideas and information

A2.2: Interpret simple documents to locate and connect information

B2.2: Write texts to explain and describe information and ideas

C3.2: Use measures to make one-step calculations

D.2: Perform well-defined, multi-step digital tasks

Performance Descriptors: see chart on last page

Materials Required:

- Pen and paper
- Computer with internet access and printer
- Attached document - V Belt Information and Sizes

OALCF Tasks for the Apprenticeship Goal Path: Prepared for the Project, *Developing Best Practices for Increasing, Supporting and Retaining Apprentices in Northern Ontario (2014)*

Task Title: Understand V-Belts and Calculate Sizes

Learner Information and Tasks

Millwrights must understand different types and sizes of V-belts for the purpose of repairing, replacing them on various industrial equipment. Read the document **V-Belt Information and Sizes** to complete the following tasks.

Task 1: What three factors determine the potential of the grip in the Belt Drive Principles?

Task 2: If V-belt length is 2/10 of inch over the nominal length, what would its match number be?

Task 3: The code number for a v-belt is 3V250 with a match #47. How many tenths of an inch is it under nominal length?

Task 4: What is the optimal speed range of the V-belt?

Task 5: Explain why Outside Belt Length can be used only as an approximation.

Task 6: What is the definition of datum length? (Use the internet to locate the document http://www.gates.com/facts/documents/Gf000209.pdf)

Task 7: Complete the information on the following areas using a case study of V-belts from the internet. (Use the following internet site to locate a case study of V-belts. http://www.gates.com/Casestudies/).

    a. Type of Industry
    b. Type of Belt
    c. Problems
    d. Solutions

V Belt Information and Sizes

Belt Drive Principles

Flat belts and **V-belts** transmit power by their grip on the **pulley** or sheave.

Three major factors determine the potential of the grip:

1. Area of contact
2. Belt tension
3. Friction between the belt and pulley or sheave surface (**coefficient of friction**)

A **belt** is a loop of flexible material used to mechanically link two or more rotating shafts, most often parallel. Belts may be used as a source of motion, to transmit power efficiently, or to track relative movement. Belts are looped over pulleys. In a two pulley system, the belt can either drive the pulleys normally in one direction (the same if on parallel shafts), or the belt may be crossed, so that the direction of the driven shaft is reversed (the opposite direction to the driver if on parallel shafts). As a source of motion, a conveyor belt is one application where the belt is adapted to continuously carry a load between two points.

Vee belts

Vee belts (also known as V-belt or wedge rope) is the basic belt for power transmission. They provide the best combination of traction, speed of movement, load of the bearings, and long service life. They are generally endless, and their general cross-section shape is trapezoidal (hence the name "V"). The "V" shape of the belt wedges firmly into a mating groove in the pulley (or sheave), with the result that the belt cannot slip off. The belt also tends to wedge into the groove as the load increases—the greater the load, the greater the wedging action—improving torque transmission and making the V-belt an effective solution, needing less width and tension than flat belts. Optimal speed range is 1000–7000 ft/min. V-belts need larger pulleys for their larger thickness than flat belts.

Trapezoid

For high-power requirements, two or more V-belts can be joined side-by-side in an arrangement called a multi-V, running on matching multi-groove sheaves. This is known as a multiple-V-belt drive (or sometimes a "classical V-belt drive").

V-belt construction

The V-belt is constructed of three main sections:
- Cover Section – Protects the inner sections from wear and abrasion.
- Tension Section – contains cords which give the belt its tensile strength. (the ability to resist stretching)
- Compression Section – supports the tension section and creates the wedging action in the sheave.
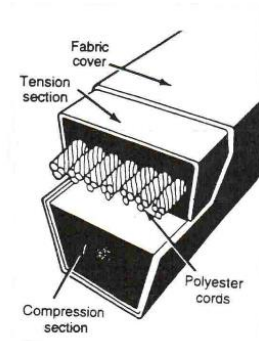
When an endless belt does not fit the need, jointed and link V-belts may be used. However they are weaker and only usable at speeds up to 4000 ft/min. A link v-belt is a number of rubberized fabric links held together by metal fasteners. They may be adjusted by removing or adding links as needed.

Definitions of V-Belt Lengths

Specifying the length of a belt can be confusing. Although we normally recommend using effective length-outside, inside, pitch and nominal length are used frequently. Each of these terms is explained.
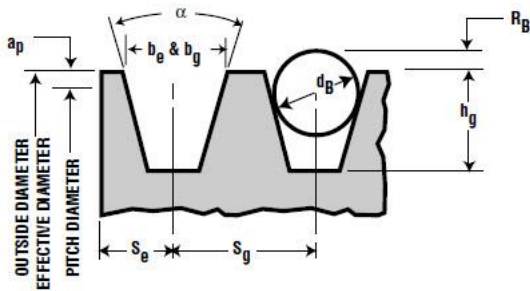
Outside Belt Length: The outside length of a belt is usually measured with a tape under no tension. Its validity is questionable since some belts have an arched top whereas others are flat. This would give different readings for the two belts. It can be used only as an approximation.

Inside Belt Lengths: The inside length is measured with flat pulleys or a tape measure. As with the outside length, the inside length varies with the manufacturer. This length should not be used.

Belt Pitch Length: The pitch length of a belt is the length at the pitch diameter of the sheaves being used. Classical industrial belts are specified in terms of pitch length. The pitch length is obtained by adding the pitch circumference of one sheave to twice the center distance between two equal diameter sheaves at a specified tension. [Belt Pitch Length is now referred to as the Datum Length.]

The belt pitch length is normally the length at the belt pitch line. This line is generally located at the neutral axis near the cord line and varies with cross section and construction. The pitch of the belt and sheave is actually a theoretical point that relates to the more accurate, reliable, and useable effective diameter and effective length.

Standard Groove Dimensions

Belt Effective Length: The effective length of a belt is the length around the effective outside diameter of a sheave at a specified tension. The effective outside diameter of a sheave is measured where the groove top width is a dimension as specified by RMA, ASAE or SAE standards.

The effective length is obtained by adding the effective outside circumference of one sheave to twice the center distance between the two standard measuring sheaves at the standard measuring tension.

Nominal Belt Length: The nominal length is used to refer to the length and cross section of a specific belt. For example, an A-38 has a nominal length of 38 inches; a 4L440 has a nominal length of 44 inches; and a 3V300 has a nominal length of 30 inches. The nominal length is used for designation purposes and exists in name only.

GatesFacts™ Technical Information Library

V Belt Matching and Measurement

Satisfactory operation of multiple belt drive requires that each belt carry its share of the load. To accomplish this, all belts in a drive must be essentially of equal length. Because it is not economically practical to manufacture belts to exact length, most manufacturers follow a practice of code making to indicate exact length.

Each belt is measured under specific tension and marked with a match number to indicate its variation from nominal length. The match number 50 is commonly added to the code number to indicate a belt within tolerance of its nominal length. For each 1/10 of an inch over nominal length, the number 50 is increased by 1. For each 1/10 of an inch under nominal length, 1 is subtracted from the number 50.

For example, a matched Classical V-belt with the code "C76" with a match #48 would indicate the following:

- C – A cross-section with a top width of .88 inches and a height of .53 inches.
- 76 – inside nominal length of 76 inches
- 48 – 2/10 of an inch under the nominal length of 76 inches

OALCF Tasks for the Apprenticeship Goal Path: Prepared for the Project, *Developing Best Practices for Increasing, Supporting and Retaining Apprentices in Northern Ontario (2014)*

Task Title: Understand V-Belts and Calculate Sizes

Answer Sheet

Task 1: What are the three factors in Belt Drive Principle

> **Area of contact**
>
> **Belt tension**
>
> **Friction between the belt and pulley or sheave surface (coefficient of friction)**

Task 2: If a V-belt's length is 2/10 of inch over the nominal length, what would its match number be?

> A Match Number over 50 refers to a belt longer than the nominal length. Each increment over 50 indicates a 1/10 of an inch over the nominal length.
>
> **Therefore, 2/10 over would be indicated by a match #52**

Task 3: The code number for a V-belt is 3V250 with a match #47. How many tenths of an inch is it under nominal length?

> **1/10 of an inch under nominal length would be indicated by a match number 1 less than 50.**
>
> **Our match number is 3 less than 50 (50 - 47 = 3), therefore, the belt would be 3/10 of an inch under the nominal length**

Task 4: What is the optimal speed range of the V-belt?

> **1000–7000 ft/min**

Task 5: Explain why Outside Belt Length can be used only as an approximation.

> **The outside length of a belt is usually measured with a tape under no tension. Its validity is questionable since some belts have an arched top whereas others are flat. This would give different readings for the two belts.**

Task 6: What does the datum system define? Using the internet to locate the document http://www.gates.com/facts/documents/Gf000209.pdf.

> **This datum system defines specific sheave and belt dimensions previously known as the pitch system for classical belts and sheaves. What were previously identified as pitch diameter or pitch length are now known as datum diameter or datum length.**

OALCF Tasks for the Apprenticeship Goal Path: Prepared for the Project, *Developing Best Practices for Increasing, Supporting and Retaining Apprentices in Northern Ontario (2014)*

Task 8:   Complete the information on the following areas using a case study of V-belts from the internet. Use the hyperlink to locate a case study of v-belts. http://www.gates.com/Casestudies/.

        a) Type of Industry
        b) Type of Belt
        c) Problems
        d) Solutions

Answers should be similar to the ones below.

Case 1

    a. **Type of Industry - Manufacturing**
    b. **Type of Belt - chains with tensioning sprockets**
    c. **Problems - High wear on chains generates frequent maintenance intervals, which leads to additional costs**
    d. **Solutions -Replace with Poly V® PK belts - nearly maintenance free**

Case 2

    a. **Type of Industry -Food Industry**
    b. **Type of Belt - Plastic modular belt**
    c. **Problems - Cleaning protocol for plastic modular belting requires taking the belts off every night and soaking them in a cleaning solution. Significant time spent repairing or replacing.**
    d. **Solutions - Gates Mectrol PosiClean® PC20 clean-in-place belting**

OALCF Tasks for the Apprenticeship Goal Path: Prepared for the Project, *Developing Best Practices for Increasing, Supporting and Retaining Apprentices in Northern Ontario (2014)*

Task Title: Understand V-Belts and Calculate Sizes

	Performance Descriptors	Needs Work	Completes task with support from practitioner	Completes task independently
A1.2	• scans text to locate information			
	• locates multiple pieces of information in simple texts			
	• makes low-level inferences			
	• makes connections between sentences and between paragraphs in a single text			
	• reads more complex texts to locate a single piece of information			
	• follows the main events of descriptive, narrative and informational texts			
	• obtains information from detailed reading			
A1.3	• integrates several pieces of information from texts			
	• manages unfamiliar elements (e.g. vocabulary, context, topic) to complete tasks			
	• identifies the purpose and relevance of texts			
	• skims to get the gist of longer texts			
	• compares or contrasts information between two or more texts			
	• uses organizational features, such as headings, to locate information			
	• follows the main events of descriptive, narrative, informational and persuasive texts			
	• obtains information from detailed reading			

OALCF Tasks for the Apprenticeship Goal Path: Prepared for the Project, *Developing Best Practices for Increasing, Supporting and Retaining Apprentices in Northern Ontario (2014)*

A2.2	• performs limited searches using one or two search criteria			
	• extracts information from tables and forms			
	• uses layout to locate information			
	• makes connections between parts of documents			
B2.2	• writes texts to explain and describe			
	• conveys intended meaning on familiar topics for a limited range of purposes and audiences			
	• uses limited range of vocabulary and punctuation appropriate to the task			
	• begins to select words and tone appropriate to the task			
	• begins to organize writing to communicate effectively			
C3.2	• calculates using numbers expressed as whole numbers, fractions, decimals, percentages and integers			
	• makes estimates			
	• converts units of measurement within the same system and between systems			
	• chooses and performs required operation(s); may make inferences to identify required operation(s)			
	• selects appropriate steps to solutions			
	• interprets, represents and converts measures using whole numbers, decimals, percentages, ratios and simple, common fractions (e.g. ½, ¼)			
	• uses strategies to check accuracy (e.g. estimating, using a calculator, repeating a calculation, using the reverse operation)			
D.2	• selects and follows appropriate steps to complete tasks			
	• locates and recognizes functions and commands			

	• makes low-level inferences to interpret icons and text			
	• begins to identify sources and evaluate information			
	• performs simple searches using keywords (e.g. internet, software help menu)			

This task: was successfully completed___   needs to be tried again___

Learner Comments

_____   _____
Instructor (print)   **Learner Signature**